2006 RESEARCH PROBLEM STATEMENT

Problem Title:	**Estimating Peak-Flow Statistics for Ungaged Streams in Utah – Development of Regional Flow-Characteristic Regression Models and a Web-Based, GIS Model User Interface**	No.:06.09-2

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1. Briefly describe the problem to be addressed:

Reliable estimates of a wide range of streamflow characteristics are needed by structure designers and resource managers. Throughout most of Utah, streamflow statistics are only available for gaged locations. Currently, those interested in acquiring these types of streamflow statistics for ungaged streams must conduct their own analyses. Comprehensive data acquisition, selection and proper employment of statistical techniques and quantitative evaluation of final results are critical components in these analyses but can be very costly and time consuming to obtain. Without a comprehensive geographic information system (GIS), complete with developed and evaluated streamflow statistical models, those in need of flow statistics acquire data from different sources, use an assortment of evaluation techniques, and generate results of varying confidence. A Web-based streamflow statistical tool will provide structure designers and resource managers with consistent and accurate streamflow estimates in a timely manner at low cost.

2. List the research objective(s) to be accomplished:

1. Compute flow statistics for USGS streamflow gaging stations in Utah and in drainages shared by adjoining states.

2. Develop regional regression equations for estimating a range of flow statistics for sites on ungaged streams in Utah.

3. Provide this up-to-date, statistical streamflow information for gaged and ungaged sites via an interactive Web-based tool known as StreamStats customized specifically for Utah streams.

3. List the major tasks required to accomplish the research objective(s):   Estimated person-hours

1. **Delineate statistically significant geohydrologic regions**. – Delineate geohydrologic regions using three factors: (1) statistically defined groups of similar basin and climatic characteristics; (2) significant physiographic features; and (3) scientific judgment based upon general knowledge of the area

2. Streamflow statistics computation at gaged sites – Calculated flood frequency estimates along with low, and monthly and annual streamflow statistics for all Utah gaging stations with 10 or more years of daily mean discharge record.

3. **Ungaged streamflow statistics estimation** – Develop regional regression equations to predict the cooperator-selected streamflow statistics at ungaged locations for each of the geohydrologic regions in Utah. These models will be built upon regional relationships between drainage basin and climatic characteristics, and computed and estimated streamflow statistics at gaging stations.

4. **Web-based user interface –** Prepare Utah geographic data for implementation into USGS national StreamStats Web-based application. StreamStats database and user interface tool will be populated with desired Utah GIS data layers. Utah streamflow gaging station statistics and developed regional regression equations will be incorporated into the national StreamStats Web-based application.

4. Outline the proposed schedule: This project is conducted by the U.S. Geological Survey in cooperation with UDOT and the Utah Department of Natural Resources (UDNR) in support of these State agency's design and resource management information needs. The project is ongoing – funded in part by the UDNR and USGS funds. UDOT funding for the project is approved in State fiscal year 2006, however the USGS/UDOT joint funding agreement has not been delivered back to the USGS office. This delay has delayed progress on the project relative to the original schedule. The project will continue on the below schedule with requested UDOT funding in FY2007.

(1) Delineate geohydrologic regions: 4/2006-8/2006,

(2) Computed streamflow statistics at gaged sites: 4/2006-6/2006

(3) Estimate (model) ungaged streamflow statistics: 7/2006-8/2007

(4) Develop GIS data base and implement web user interface and reporting – 10/2005-8/2007

All tasks will be completed by the USGS with regular reporting of progress and plans to UDOT managers.

5. Indicate type of research and / or development project this is:

Large: x Research Project ☐ Development Project	
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative : ☐ Other	

6. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)? The Streamstats technology is unique to the USGS. They are also the collecter and maintainer of the model data and best suited for this work.

7. What deliverable(s) would you like to receive at the end of the project? All processed and computed data will be incorporated within the Utah StreamStats web-based GIS tool and accessible to UDOT designers. For each set of statistical models that are developed, a USGS report describing their development, application and use will be prepared. Documentation for the Utah StreamStats application will be prepared and made accessible from the StreamStats interface.

8. Describe how this project will be implemented at UDOT. Project deliverables will be developed and completed by the USGS. Project products including streamflow statistics models and web-base user interface will be available for use by UDOT staff at the end of the project. Reports documenting the streamflow statistics models and user interface will be published by the USGS and made available to UDOT staff.

9. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be. The project will:

- Provide updated, accurate information on streamflow statistics (streamflow regression models for peak-flow statistics) for gaged and ungaged sites on streams in all Utah basins.
- Incorporate all available streamflow data at gaged streams to improve the accuracy of model-computed streamflow statistics.
- Incorporate new GIS environmental-characteristic data layers, not readily available or synthesizable in previous studies, to improve the accuracy of the modeled relation between basin characteristics and streamflow.
- Create a Web-based user interface that will allow access to and use of the model via an interactive map server eliminating the need for costly independent analyses
- Allow on-the-fly basin delineation from a user-defined stream point and immediate computation of delineated basin characteristics required by the streamflow regression equations. (Basin characteristics computation via the Web applications ensures that the method for computation is the same as that used in the development of the regression equations.)
- Provide estimated streamflow statistics for user-selected ungaged sites and standard errors of estimate or prediction and confidence intervals.

Resulting tools will save UDOT designers significant time and money by allowing point and click computation of streamflow statistics needed for road and structure design near water features.

10. Describe the expected risks, obstacles, and strategies to overcome these. Timely completion of funding agreements is key to meet project timelines. The USGS will prepare a Joint Funding Agreement for each fiscal year of funding to allow use of USGS Cooperative Water Program matching funds in support of the work.

11. List the key UDOT Champion of this project (UDOT employee who will help Research Division steer and lead this project, and will spearhead the implementation of the results): Michael Fazio, UDOT Manager, Central Hydraulics

12. Estimate the cost of this research study including implementation effort (use person-hours from No. 3): UDOT project contribution in FY2006 was $35,000. The estimated UDOT contribution in FY2007 is $35,000

13. List other champions (UDOT and non-UDOT) who are interested in and willing to participate in the Technical Advisory Committee for this study:

Name	Organization/Division/Region	Phone
A) Boyd Clayton	Utah Department of Natural Resources Quality, Div. of Water Rights	538-7390
B) Todd Adams	Utah Department of Natural Resources, Div. of Water Resources	538-7272
C)		
D)		

14. Identify other Utah agencies, regional or national agencies, or other groups that may have an interest in supporting this study:
Utah Department of Environmental Quality, Water Quality, US Forest Service,